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Breeding Biology of a Southeastern Population of Tree Swallows Tachycineta bicolor

Denise Stephens
Western Kentucky University

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Denise Rouse

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BREEDING BIOLOGY OF A SOUTHEASTERN POPULATION OF TREE SWALLOWS
Tachycineta bicolor

A Thesis
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In Partial Fulfillment of
the Requirements for the Degree
Master of Science

by
Denise Rouse Stephens
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BREEDING BIOLOGY OF A SOUTHEASTERN POPULATION OF TREE SWALLOWS
Tachycineta bicolor

Recommended 12-20-91
(Date)

Blaine R. Ferrell
Director of Thesis

H E. Shadowen

Jon E. Winstead

Approved January 9, 1992
(Date)

Elmer Gray
Dean of the Graduate College

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This thesis is dedicated to my husband, Jeff, who encouraged, supported, and assisted my work in the field, and made this body of work possible.

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Sharon Denise Rouse Stephens December, 1991 30 pages

Directed by: Dr. Blaine R. Ferrell, Dr. Herbert E. Shadowen and Dr. Joe E. Winstead

Department of Biology Western Kentucky University

An Ohio County, Kentucky, population of Tree Swallows utilizing nest boxes located over a strip pit lake on reclaimed Peabody Coal Company land was studied on a weekly basis throughout its breeding season. The season lasted from late April to late July. Dates and/or numbers were recorded regarding nest building, egg laying, clutch size, hatching and fledging success, age of females and adult activity at the nest in order to make comparisons with these data collected in studies of more northern populations. In addition, incubating females were color marked in order to determine if they produced a second clutch. No second clutch was produced by the same female at this site. However, a second group of females did exhibit a late reproductive effort with significant success. Results indicate that the temporal breeding pattern in this southeastern population is different from the pattern observed in the more northern populations. Although the first group of females did not produce two clutches, two distinct nesting cycles were evident and the breeding season was extended in time.

INTRODUCTION

Historically, Tree Swallows (*Tachycineta bicolor*, see also *Iridoprocne bicolor*) were not recorded as breeding in Kentucky. According to Mengel (1965) some transient populations were documented in the late 1800s, but these seemed to have gradually disappeared. By the middle of the 1900s the species was again noted with some regularity as it migrated through certain areas of the state (*i.e.*, primarily near water bodies and bottomlands). Despite the fact that Tree Swallows bred in southern Illinois and to the west of the Mississippi River in Missouri, they only represented a migratory species in the Purchase area of Kentucky (Mengel 1965). No known record exists of any Tree Swallow population breeding in Kentucky until recent times. However, Mengel (1965) noted that by the 1960s the species seemed to be well established near marshy areas and bottomlands. According to Allaire (1980) Tree Swallows were uncommon migrants in the eastern climatic region of Kentucky and were found only in mountain-top strip mine areas that had been reclaimed. Allaire further noted that swallows utilized ponds and marshy areas for drinking while taking advantage of the flat, grassland areas for feeding.

By the middle of the 1980s Tree Swallows were commonly found in the western climatic region of the state on recovered strip mine lands of Peabody Coal Company in Ohio and Muhlenberg counties in association with numerous strip pits. Tree Swallows

often depend on woodpecker holes (Imhof 1976, Salt and Salt 1976) and/or hollow trees (Bent 1963) for nest cavities, and such sites were initially abundant on strip-pits. With the depletion of these types of nest sites over strip pits through decay, alternative nesting sites needed to be provided. Thus, 50 nest boxes were erected in 1988 to replace deteriorating natural nest sites (*i.e.,* dead trees) in the Ohio County area. This area represented an ideal setting for studies of their breeding biology.

Undocumented observations made in 1990 of Tree Swallows utilizing these nest boxes in Ohio County, Kentucky, indicated that two clutches might have been produced. Thus, an opportunity existed to determine if Tree Swallows produce two clutches per season in their southeastern breeding range, instead of the typical single clutch of their more northern counterparts. Hussell (1983a) reported a single instance of Tree Swallows raising two clutches in the same breeding season in Canada on two separate occasions. In 1979 one pair was documented as raising two clutches, albeit in separate nest boxes. The two clutches raised in 1982, again by a single pair of Tree Swallows, occurred in the same nest box. The Hussell report came as additional support to previous accounts of double clutches among Tree Swallows by Weydemeyer (1934 and 1935), Chapman (1955) and Ehrlich, Dobkin and Wheye (1988). These accounts would appear to be anomalies, in that Tree Swallows normally have a single clutch per breeding season (Kuerzi 1940-1941, Chapman 1955, Hussell 1983a, Harrison 1975, Stokes and Stokes 1979). Furthermore, Kuerzi (1940-1941) stated that those cases where two clutches were believed to have

occurred were usually 'repeat clutches' rather than second clutches and that no second clutches had ever been documented in New England.

Studies have shown second clutches occur more frequently in birds of more southern latitudes than in northern counterparts among other bird species that have extended their range into an area with increased breeding season length and/or increased food resources (Middleton 1979, Smith 1982, Hussell 1983a, Blancher and Robertson 1982, Geupel and DeSante 1990). Added to this is the fact that Tree Swallows are the first of the swallow family to begin returning north in the spring (Bent 1963, Salt and Salt 1976) and thus are likely the first to begin their breeding season. To our knowledge no studies have been conducted on the breeding biology of Tree Swallows that have extended their range into the southeastern areas of North America. This study was undertaken to determine what differences, if any, might exist in the breeding biology of Tree Swallows in this southeastern region compared with more northern populations. Thus the experimental hypothesis was formed that with the southern extension of their breeding range Tree Swallows, like other species, would alter the temporal pattern of breeding and possibly increase the number of successful clutches from one to two each breeding season.

MATERIALS AND METHODS

To observe what alterations in reproduction if any had occurred in association with an extension of range southward, a Tree Swallow population at a reclaimed strip mine in Ohio County, Kentucky, served as a test population. In cooperation with Peabody Coal Company, a research site was set up at Twin Tiles Lake. The lake is located within sight of the Paradise Steam Plant and is also located in an area where mining is in progress. The lake is surrounded on the eastern and western shores primarily by shrub vegetation with some stands of coniferous trees within 100-200 m of the shoreline on all sides.

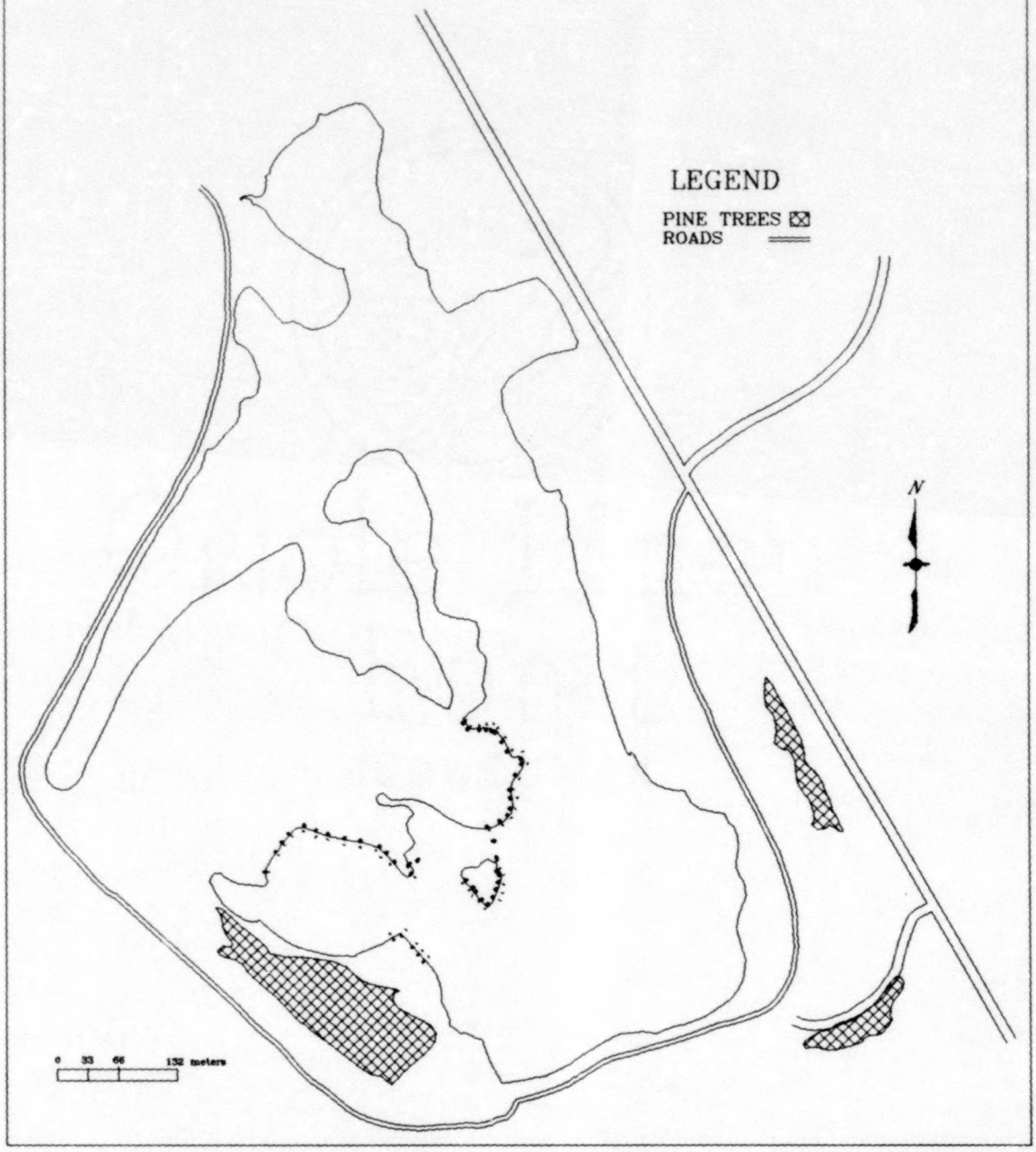
Forty-nine wooden nest boxes (15.2 x 12.7 x 12.7 cm with a 3.8 cm diameter entrance hole) were placed on metal posts approximately 0.61-0.92 m over the water. Wooden boxes represent a preferred nesting site for Tree Swallows (Bent 1963). The nest boxes were painted with a light gray paint (Kuerzi 1940-1941) to simulate natural conditions and also to reflect heat during the summer. The boxes were placed over water at the Twin Tiles Lake site because it had been determined that Tree Swallows preferred nest sites over water compared with sites over land (Ferrell 1990, unpublished). That Tree Swallows prefer to nest over water is supported in the literature by Bent (1963) and probably relates to avoidance of predation by land animals. The nest boxes were put out in mid-March to give returning males time to begin the nest selection process. The boxes were placed

approximately 11 m apart in accordance with previously reported distances by Muldal, Gibbs and Robertson (1985) and 3 m from the shore (Figure 1). This distance placed the boxes only half as far apart as other studies (Stokes and Stokes 1979, Hussell and Quinney 1985, Robertson and Rendell 1990). Observations were made from a canoe. Entrance hole orientations were random to note preference for land versus water entry.

The nest boxes were erected on March 23, 1991. Four weeks later on April 21 the weekly checks began. The nest boxes were checked at approximately seven-day intervals in accordance with a previous study by Burtt and Tuttle (1983), and the study period lasted from late April until late July. Observations were made and data recorded as to the presence of nests, the number of eggs, the number of hatchlings, and the number of fledglings. The general time period for these observations came in the late evening (*i.e.*, just at dusk) and/or in the early morning (*i.e.*, just prior to sunrise) as the birds were typically away from the nests during the middle of the day. Data taken on swallows at each nest box included the following: adult birds at the box (*e.g.*, male and/or second year or after second year females); the nesting stage (*e.g.*, no nest, a flat platform, a nest cup, and a feather lined nest); the number of eggs present and also any eggs that were abandoned or missing; the number of hatched young and their plumage stages (*e.g.*, stages included young that had just hatched through fledged juveniles); and the number of fledglings. A "fledgling" consisted of any of the hatchlings that successfully left the nest, and no additional post-fledged census was taken. Mortality figures were noted for

Figure 1. Map of Twin Tiles Lake. Locations of nest boxes in relation to the lake are indicated by the dots.

TWIN TILES LAKE
OHIO COUNTY, KENTUCKY



hatchlings that died or were missing from a nest box prior to the appropriate fledgling time. Environmental data taken included the time of day observations were made, the weather conditions (*i.e.,* wind speed, wind direction, cloud cover, etc...), and any unusual lake conditions.

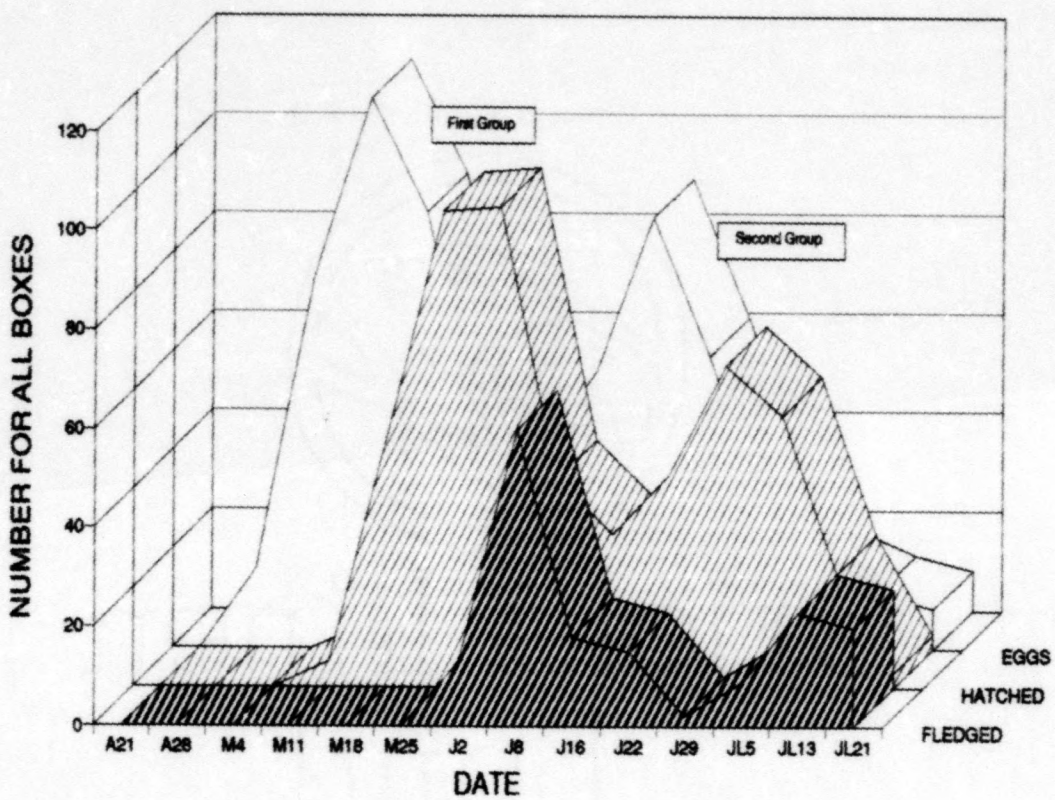
Females captured on the nest were marked for individual identification by using a taped-tail feather technique (Best 1991) at two appropriate times during the nesting period. This marking technique involved notching the vane of the two outermost tail feathers (*i.e.,* retrices) using scissors, folding pieces of colored tape around the shaft in the notched area and cutting the tape to match the contour of the feathers. Distinctions between second year and after second year females were based on plumage color. The second year females were mainly brown along the back, whereas after second year females had iridescent plumage over at least 50% of the back. These distinctions were made with a 95% confidence level and were based on criteria established by Kuerzi (1940-1941), Stokes and Stokes (1979), Hussell (1983b), and Leffelaar and Robertson (1985). The first set was banded on May 15-16, and the second set was banded on June 20. These periods came at appropriate times just prior to or just after the eggs hatched (Burtt and Tuttle 1983, Quinney 1986, Lombardo 1986 and 1989) in order to allow easy nest capture, yet minimizing the possibility of nest abandonment. The markers included color combinations of red, blue, yellow and white. Females were hand captured on the nest early in the morning (*i.e.,* the most effective time for capture) and were released immediately after being

marked. Each bird's condition was observed following the banding process to check for any complications. No complications due to the banding process were noted and no abandonment or increased predation rates were noted.

RESULTS

As is clearly shown in Figure 2 two distinct periods of egg laying, hatching and fledging activity occurred. Twenty-four nest boxes were still in use when the second reproductive group began laying eggs on June 20. Generally, in both reproductive groups, every other nest box was used which placed nests approximately 20+ m apart. No preference was noted during either reproductive group as to nest selection in relation to entrance hole position (*i.e.*, facing land versus facing water). Despite foggy, overcast skies, the birds became very active toward the end of the second marking procedure. Of particular note was a male at B21. The box contained four newly layed eggs belonging to a second year female. At each approach by canoe, the male, either sitting on the box or sitting on a stick-up near the box, would give a "warning" call and hover in front of the nest hole, and the female would immediately leave the box. Other adults in the area would dive at the canoe immediately after the call. By June 22 B8 had become a usable box again while B7 was designated unusable due to a second Eastern Bluebird, *Sialia sialis* , nest. At B16 a fledged juvenile was observed returning to the box after all juveniles in that box had fledged. Midday temperatures and humidity were increasing at this time. Arthropod ectoparasites were becoming more common in and around the nest boxes, and thus on June 20 and 29 old nests were removed from those nest boxes that were by then inactive. Two more instances of staggered chick development were noted in B39

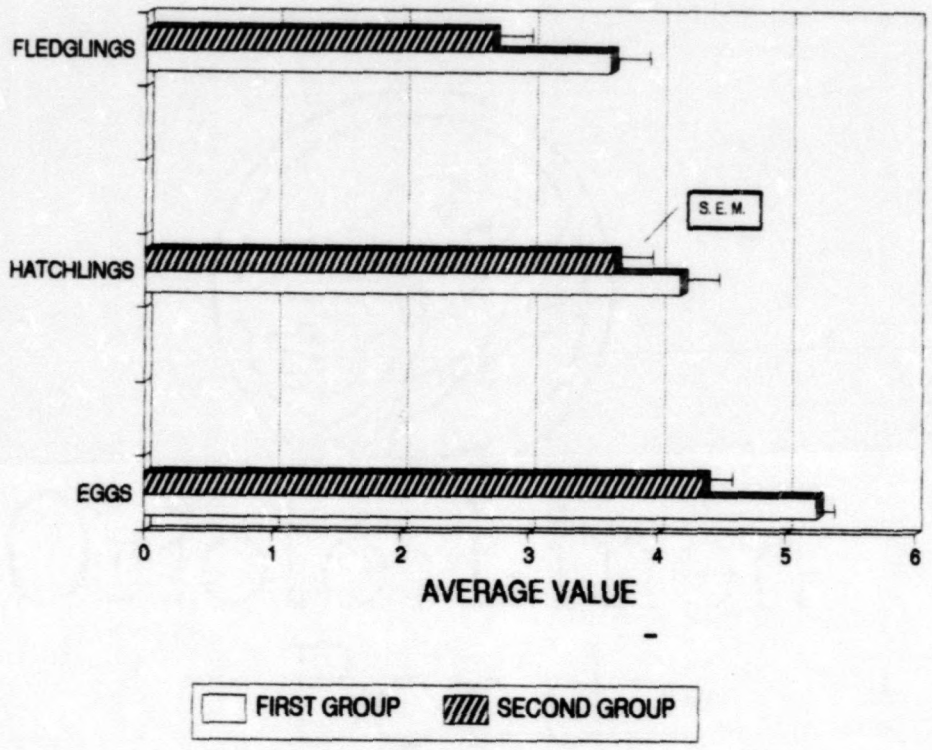
Figure 2. Summary of breeding activity from April 21 to July 21, 1991. April = A; May = M; June = J; July = JL.


NUMBER FOR ALL BOXES
120
100
80
60
40
20
0
First Group
Second Group
EGGS
HATCHED
FLEDGED
A21
A28
M4
M11
M18
M25
J2
J8
J16
J22
J29
JL5
JL13
JL21
DATE

and B46. The area was very active with most of the fledged juveniles fluttering around inactive nest boxes. Copulation by an adult pair around B35-B36 was noted on July 13. Additionally, the male and the after second year female at B37 were active near the box, and the female entered the box at regular intervals in a presumed effort to incubate the four eggs in the box. These observations seemed to indicate that breeding activity was continuing. However, no new nest construction or egg laying was occurring in the nest boxes. The number of mites in the nest boxes with hatchlings had increased dramatically. The overall decline in the average clutch size between the first and second reproductive groups, from 5.24 to 4.35 respectively, was not unusual (Figure 3). Despite the decline in clutch size, mortality rates between the two reproductive groups were similar (*see also* Lomardo 1989, Blackburn 1991). By July 21 the eight eggs left in four of the nest boxes (B14, B16, B27, and B37) were recorded as being infertile or abandoned. By this time all but three hatchlings in the second set had fledged and these three were at the fledging stage.

The only marked females observed at Twin Tiles Lake and adjacent lake areas were those females that still had hatchlings in the nest. Subsequent searches were conducted for the marked females in the first breeding set and also for the marked females in the second breeding set. No other remaining marked females were present at Twin Tiles Lake and adjacent lake areas following their respective reproduction period. Nonetheless, documentation now exists of females (*i.e.*, primarily after second year females) raising a clutch earlier in the breeding season and allowing time

Figure 3. Average number of eggs, hatchlings and fledglings for nest boxes by reproductive group. S.E.M. = standard error about the mean.


FLEDGLINGS
HATCHLINGS
EGGS
S.E.M.
0
1
2
3
4
5
6
AVERAGE VALUE
FIRST GROUP
SECOND GROUP

for themselves and/or other females (*i.e.,* more second year females in this group) to also raise a clutch during the same breeding season (Figure 4). Although the after second year females were not present in a proportion similar to more northern populations when considered for the entire season, they did show a similar pattern if the first reproductive group was considered alone (Figure 5). In comparison, for the second reproductive period the percentage of nest usage by after second year females was much lower due to the increasing usage by second year females (Figure 6).

At some point during the fourteen week study period, 41 of the 45 available nest boxes were utilized, and seven of these were reused for a total of 48 (artificial) Tree Swallow nests at Twin Tiles Lake. This high percentage of nest box utilization was used to calculate the efficiency rating for the season. No information was obtained on any Tree Swallows that nested in natural cavities. Five of the seven boxes reused were occupied within seven days after the first clutch fledged. This reuse of nest sites, as in all cases of the second reproductive group, was by a new group of females. No new nest construction was noted before eggs were layed in the reused nest boxes. Over the entire breeding season this population of Tree Swallows layed 239 eggs of which 194 hatched (81.2% hatchling rate). One hundred-fifty-nine of those hatchlings had fledged (83.5% fledgling rate) by July 21 (105 in the first group and 54 in the second group). Thus 51 eggs were lost to predation, abandonment and/or were infertile, and 32 hatchlings were preyed upon or died (Table 1). On October 8 the nest boxes were

Figure 4. The percent usage of boxes by second and after second year females as recorded for the 1991 breeding season.

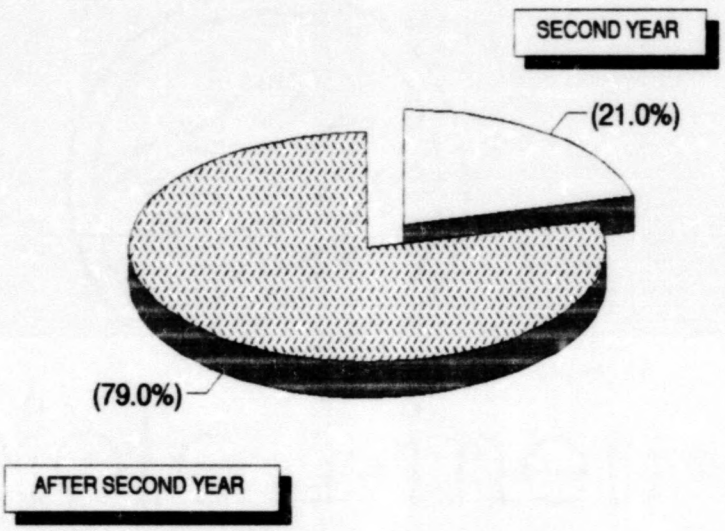

SECOND YEAR
(21.0%)
(79.0%)
AFTER SECOND YEAR

Figure 5. The percent usage of boxes by second and after second year females in the first reproductive group.

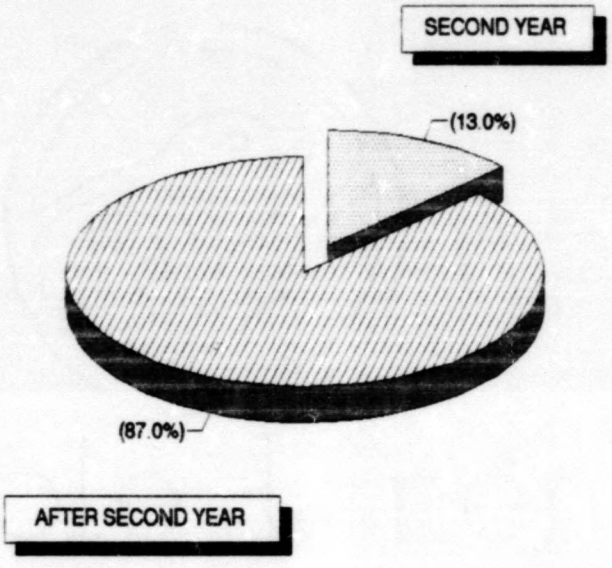

SECOND YEAR
(13.0%)
(87.0%)
AFTER SECOND YEAR

Figure 6. The percent usage of boxes by second and after second year females in the second reproductive group.

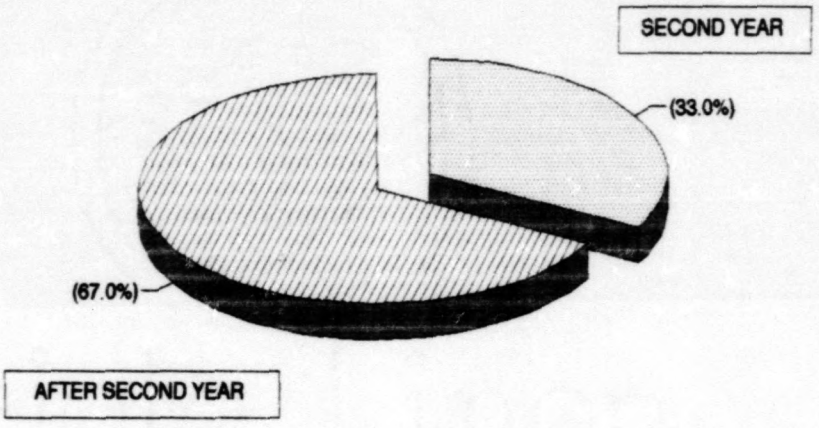

SECOND YEAR
(33.0%)
(67.0%)
AFTER SECOND YEAR

Table 1. Mortality of Tree Swallows at Twin Tiles Lake.

		Mortality Figures	
Date	Nest Box	Eggs	Hatchlings
M18	32a*		1
M18-J22	10a	5	
M25	19	5	
M25	30		1
M25	35	1	
M25-J16	38	1	1
J2	42		3
J2	44		1
J8	5		1
J2-J16	37		1
J16	4	2	
J16	40		2
J22	10a	5	
J22-JL5	14	3	
J22-JL5	27	2	
J29	6		4
J29	11		1
J29	25		1
J29	43		1
JL5	41		1
JL5	49		1
JL5-JL13	2		1
JL5-JL13	31b**		2
JL13	20		2
JL13	32b		1
JL13	34		4
JL13	46		2

*-a refers to first reproductive group; **-b refers to second reproductive group

removed for the winter, and at this time five juveniles were found dead in four of the boxes. Assuming that these were fledglings from this lake, their loss reduced the overall fledgling rate to 79.4% for the season. Again these figures do not reflect a post season census on the juveniles.

Although few birds were present on the first check date, there was ample evidence that nest construction had already begun. Twenty-nine nest boxes on April 21 had evidence of nest construction (*i.e.,* nest construction ranged from grass or pine needle platforms to feather lined nests), and two boxes (B29 and B36) were too damaged by wind for usage. By April 28 six boxes had eggs in them, two with complete clutches (*i.e.,* 5-6 eggs) and four clutches just beginning. Several pairs were observed courting while other pairs were observed copulating. Although a storm front was present again, the birds were very active around the nest boxes. On May 4 one pair of Tree Swallows was found dead in a PVC pipe that had been erected in the lake to hold a nest box during the previous year. Around some of the nest boxes other Tree Swallows were "fighting" for feathers that had blown away from a box. This indicated that most nest construction had been completed and most females in the population were ready to lay eggs. Two more nest boxes (B8 and B45) were deemed unusable (*i.e.,* one contained an Eastern Bluebird nest and the other suffered wind damage), leaving a total of 45 usable nest boxes available for the season. B19 contained two eggs with no nest material present. At first this appeared to be an anomaly as no other female had layed eggs without first constructing a nest; however, this does

occur among Tree Swallows, although more predominantly with the second year females according to Kuerzi (1940-1941). Stormy weather on May 11 was again the apparent cause of few adults being present around the lake area. The adults that were present included primarily those females incubating eggs.

With the return of warm and sunny weather the birds were quite active around the lake area. On May 18 an example of mobbing behavior was exhibited when the female at B13 gave a distress call. To date, the harassing dive tactic of the Tree Swallows has been observed on each trip. This behavior was exhibited and initiated by adult males, adult females, and even juveniles later in the season. The hatchlings responded to the opening of the lid as if a parent was present. This behavior would cease after the first week when feathers were beginning to come in and the young were becoming more aware of their environment. On May 25 three adults were observed feeding the five juveniles in B32. These juveniles were among the first to reach the fledgling stage. However, it was not known whether the additional adult was a second year male or female and/or whether it was the offspring of either of the adults it apparently was assisting. While the adults in B43 were feeding the hatchlings, two other adults became very aggressive toward the author. No distress call was heard and no other nest box was being monitored at the time. Such behavior was not noted again unless first accompanied by a distress call. On June 2 observations were made of the female at B3 feeding her hatchlings, and the marking on the tail feathers was easily seen. All fledglings were presumed to have been

successful, and no follow-up census was conducted at the end of the study period. The weather since May 25 had been clear and no rainstorms occurred. Morning temperatures were warm with relatively high temperatures during the middle of the day. On June 16 the birds were again active. The first occurrence of staggered hatchling growth appeared at this time in B6.

DISCUSSION

Two separate reproductive periods occurred during the 1991 breeding season at Twin Tiles Lake. The first group of eggs was layed much earlier (Figure 2) than their more northern Tree Swallow counterparts that lay the first eggs roughly in late May in Montana (Chapman 1955) and in early May in New England (Kuerzi 1940-1941); the second group of eggs was layed much later (*i.e.*, later than May 31 or June 4) compared with more northern populations (Hussell and Quinney 1985). Hussell (1983a) states that two possible events happen to gain the time necessary for two clutches to be raised successfully in the same season. These include (1) reducing the time spent in parental care and (2) reducing the time between clutches. This second event occurred at the Twin Tiles Lake area. Hussell further states that the breeding season must begin earlier and end later for females to successfully raise two clutches. The expansion of the breeding season, as occurred at the Twin Tiles Lake site, would allow sufficient time for two clutches. However, to our knowledge no eggs in the second reproductive group were layed by a female that successfully layed and raised a first clutch. The time span for egg to fledgling development was approximately six weeks. When compared to more northern populations this represents a longer period of time for the egg to fledgling development. This data does corroborate data obtained at this same site the previous year by

Ferrell (unpublished). A second group of eggs found this late in the season (*i.e.,* in July) is atypical of northern populations.

The general pattern of box utilization was every other box, which placed nests approximately 20+ m apart, and was similar to the spatial preference observed in more northern populations (Stokes and Stokes 1979, Hussell and Quinney 1985, Robertson and Rendell 1990). Members of the second reproductive group utilized every other box that had not been used by members of the first reproductive group with the exceptions of the seven boxes that were reused. Nesting females showed no significant preference as to water entry versus land entry in choosing boxes with randomly positioned entrance holes. In a previous study by Hussell and Quinney (1985) with a population in southern Ontario, orientation of the entrance hole eastward was used to provide protection from prevailing weather patterns. Weather fronts at Twin Tiles Lake moved primarily from the northwest to the southeast during the summer months, but again no significant effect was seen regarding nest box preference based on the direction of the entrance hole, in either reproductive group.

The high number of nests utilized (*i.e.,* 48 nests in the 45 available nest boxes) during 1991 gave a very high efficiency rating (107%) for the season's nesting activity as compared to a 59.7-70.4% efficiency rating in more northern populations studied by Kuerzi (1940-1941), Chapman (1955), and Muldal, Gibbs and Robertson (1985). The longer delay of approximately six weeks that was observed in the second nesting onset, primarily by after second year females, was quite different from the "normal" period

of 14-16 days in more northern populations (Muldal, Gibbs and Robertson 1985). It seems unlikely that the two distinct reproductive groups was an artifact of nest competition in light of the fact that the delay was more than the 14 days observed in more northern populations. Male Tree Swallows will allow more dense packing, but generally only after a delay of 14 days when aggression wanes due to involvement in feeding the hatchlings (Stokes and Stokes 1979). The reuse of some of the first reproductive group's nests did allow for a shorter delay in the onset of the second reproductive group for some of the second reproductive group females, but the majority of the second reproductive group birds did exhibit a longer delay in nesting onset. Thus the temporal breeding pattern at Twin Tiles Lake was significantly different from that of the northern breeding populations while the average clutch size remained similar to northern populations.

Mortality of hatchlings almost ready to fledge was determined by the number of carcasses recovered from nests (a total of nine during the season) and probably resulted from the increased number of ectoparasites rather than elevated temperatures in the nest boxes (Weydemeyer 1935, Chapman 1955, Hussell 1983a). However, as no taxonomic analysis was made of the parasites found in and around the boxes the notion that parasites were responsible for these deaths could not be substantiated. A second possible explanation for their death may have been starvation. According to Kuerzi (1940-1941) if food sources fall short for even a brief time, such as after a rain storm,

then hatchlings may starve to death since the adults may not be able to provide enough food. Although no heavy rain occurred in the latter part of the season at Twin Tiles Lake, a drop in resources may have occurred from some other factor (*i.e.,* decrease in insect populations because of dry conditions). No detrimental effects to eggs and/or hatchlings were attributed to the higher temperatures that occurred later in the season. The hot temperatures were not considered to be the cause of death because Tree Swallows hatchlings can withstand temperatures as high as 36.7º C (Weydemeyer 1934, Kuerzi 1940-1941), and even though the temperatures inside the boxes increased later in the season they did not stay above 36-37º C for extended periods.

Several possible explanations existed about the disappearance of the first reproductive group females, but no firm conclusion could be drawn. No extended searches were made beyond the group of lakes around Twin Tiles Lake nor sighting data collected from around that region of the state. One possibility is that the females continued to move farther north or nested elsewhere in the area outside the research area that was checked. This is based on the premise that the distance that females move from nesting sites may range up to twenty miles from year to year (Chapman 1955). The most likely conclusions to be drawn from this movement by the first group of females and their fledged young would be predator avoidance (Stokes and Stokes 1979, Wheelwright and Dorsey 1991) and/or to reduce resource competition (Zach 1982). A more likely explanation is that these females left the breeding area after their hatchlings had fledged

and, along with their fledglings, joined other swallows elsewhere (Stokes and Stokes 1979) before returning south for the winter.

Some of the behavior observed in the population at Twin Tiles Lake this season was noteworthy. At first the eggs layed in B19 by an after second year female and without a nest appeared to be an anomaly as no other female had layed eggs without first constructing a nest. However, this does occur among Tree Swallows, although more predominantly with the second year females (Kuerzi 1940-1941). The staggered hatchling development observed on June 16, 20 and 29 was not unusual if incubation began before the full clutch was layed (Zach 1982). Such asynchronous hatching effort may be connected to parental effort (Zach 1982, Hussell 1983a) as well as environmental conditions and food resources (Zach 1982). According to Zach (1982) reduction in the post-hatched brood size can often be the result of seasonal and annual fluctuating food resources and thus may represent an atypical aspect in the breeding biology of Tree Swallows. The findings at this southeastern site are further supported by Wiggins (1990), who stated that various factors (*i.e.*, geographical location, time of season, female age, and environmental conditions such as prey availability) may affect clutch size, at least by annual fluctuations, and therefore the overall breeding biology of the Tree Swallows. Such effects might account for the decreased clutch size in the second reproductive group. Therefore, by staggering the hatchling development the reproductive potential for the season may not drop significantly. Finally, Lombardo (1986) notes that continued mating behavior

late in the season commonly occurs and is not significant. This would explain the behavior noted at B35-B36 on July 13. No eggs were layed as a result of this late copulation. Likewise, the late incubation activity at B37 did not result in a second viable clutch from that box.

In conclusion, the competition for nest sites (*i.e.*, as a result of limited nest site availability) was not the likely reason for the two separate reproductive groups. Rather, the change in the temporal breeding pattern might be in response to reduced maximum day length and extended breeding season length at this latitude compared with these parameters at the latitudes of northern populations studied. Thus these were possible reasons for two groups of females successfully reproducing during 1991 at Twin Tiles Lake. The extension of the breeding season, as compared to more northern populations, was clearly documented (*i.e.*, the females began the breeding season earlier than northern populations and finished the breeding season later than northern populations) while other aspects of the breeding biology did not appear to be significantly different from northern populations (*i.e.*, clutch size). While some alteration had occurred in the breeding biology of this population of Tree Swallows (*i.e.*, by season extension and thus two nesting cycles) the extent of such alterations was not completely documented in this study. Thus continued research with the females and the males at this site would be beneficial.

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